

OVERNIGHT SERVICE

February 6, 2017

Office of Performance Management and
Innovation

Overview

- The FMCB asked for additional data on the need for transit service between the hours of 1am and 5am
- The MBTA worked with cities of Boston and Cambridge and advocates to conduct a survey of potential passengers
- OPMI analyzed the survey and MBTA, Hubway, and taxi data for key themes of overnight travel needs
- Five different traveler types were identified
- Staff is looking for FMCB direction on next steps and how to prioritize different travel needs

Overview of Process

- Is there enough need to justify providing service? →
- How should we evaluate the success of a service?
- What funding level is available?
- How should the service be designed and operated?
- Overnight Data Sources
- Key Themes
- Service Constraints
- Traveler Types
- Next Steps

Key Themes

- Evidence of demand between 1am-5am
- Demand and Origin and Destination patterns not evenly distributed between 1am-5am
- Service Design depends on Travelers Types
 - Workers
 - Frequent Early Morning to Work
 - Frequent Late Night from Work
 - Infrequent
 - Non-Work travelers
 - Social/Recreational Travelers
 - Airport Travelers

DATA SOURCES

- Stated Preference Data- Limited because behavior may differ, and self-selected sample so can't generalize or estimate ridership demand
- Revealed Preference Data- Limited since no service exists

Stated Preference Survey Goal

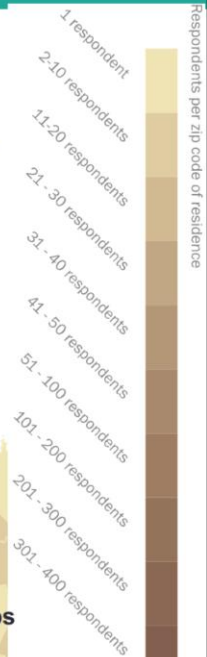
- Potential passenger information not available from revealed preference data:
 - Acceptable service levels for actual use
 - Likelihood of use
 - Frequency of use
- Employer information – impact of service availability
- Because survey respondents were not randomly selected, we can't generalize or estimate ridership demand

Survey of Potential Passenger Respondents

- Conducted online 11-12/2016
- In 8 languages
- Outreach strategies
 - Online outreach/Twitter/social media
 - City of Cambridge & City of Boston outreach
- Current travel patterns 1am-5am and potential use of overnight service
- Usable N: 7,278
- High response rates for most demographic categories except age

62% are 22-34 years old, majority report travel for Non-Work trips

MBTA Overnight Survey of Potential Passengers – Nov/Dec 2016



Approximately 4,700 reported currently traveling for Non-Work purposes during the hours of 1-5am.

Approximately 2,000 reported currently traveling for Work purposes during the hours of 1-5am.

Employer Survey Respondents

- City of Boston outreach
- 131 surveys received, 96 from employers in Greater Boston with overnight employees

Predominantly restaurants, businesses at Logan Airport, health care facilities, and services (catering, food and janitorial services, security, hotels)

Number of employees
per employer respondent



Revealed Preference Data Sources:

- MBTA Origin-Destination-Transfer (ODX) model data
 - Passenger-level journeys and rides, inferred from AFC and AVL data using the origin- destination- and transfer-inference (ODX) algorithm
 - October 2015 during previous late night service
- Hubway
 - Trip-level rides with origins, destinations, and times for every Hubway trip
 - October 2015 and 2016
- Taxi
 - City of Boston taxi cab pick-up and drop-offs. Locations outside of central business districts were excluded from the data set.
 - October 2012

EVIDENCE OF DEMAND

- Stated demand in the survey
- Use of taxi late at night
- High ridership on first and last trips of existing bus routes

Current Travel Patterns

Survey of Potential Passengers

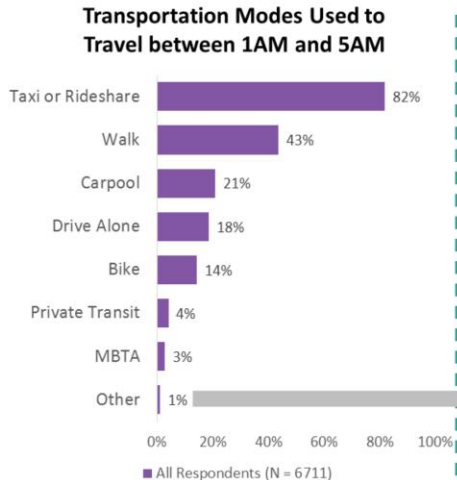
- 71% report current travel between 1am and 5am at least once a week
- Only 8% “never travel” at that time
- Approximately 2,000 respondents travel for work; approximately 4,700 travel for non work-related reasons

Employer Survey

- Employers reported most arrival or departure times between 1am and 3am; with variation by industry
- Employer transportation subsidies (most do not subsidize):
 - MBTA passes
 - Parking subsidies
 - Cab/Uber/Lyft fares

City of Boston Employer Survey – Nov/Dec 2016

Current Travel Patterns



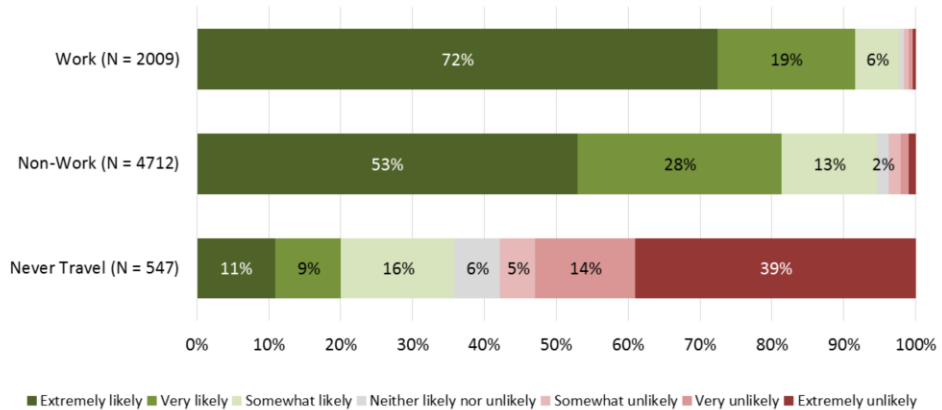
“Other” methods include:

- “I have had to sleep on the floor in my office from time to time.”
- “Stay at workplace or call out”
- “Wait for the train to start”
- “Not make the trip due to lack of transportation”

MBTA Overnight Survey of Potential Passengers – Nov/Dec 2016, City of Boston Employer Survey – Nov/Dec 2016

No substantive differences between people who travel for work and non-work related purposes in terms of the modes they currently use to travel between 1-5am.

Self-Reported Likelihood of Using Overnight Bus Service



MBTA Overnight Survey of Potential Passengers – Nov/Dec 2016



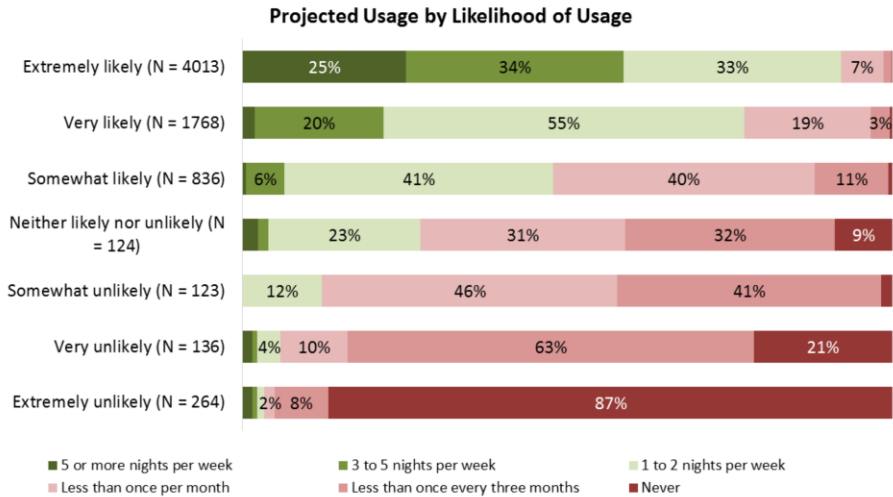
People who currently travel for work between 1am and 5am – over 90% very or extremely likely to use overnight bus service.

People who currently travel for non-work reasons between 1am and 5am – over 80% very or extremely likely to use overnight bus service.

People who don't currently travel between 1am and 5am – only 20% very or extremely likely. Not a high latent demand for travel overnight if people already aren't travelling.

Frequency of travel explains the difference between Work and Non-Work categories – people who currently travel more frequently are more likely to use overnight service; people who travel for Work tend to be more frequent travelers, but people who travel for Non-Work reasons frequently are just as likely as frequent Work travelers to report high likelihood of using overnight bus service.

Self-Reported Projected Usage of Overnight Bus Service

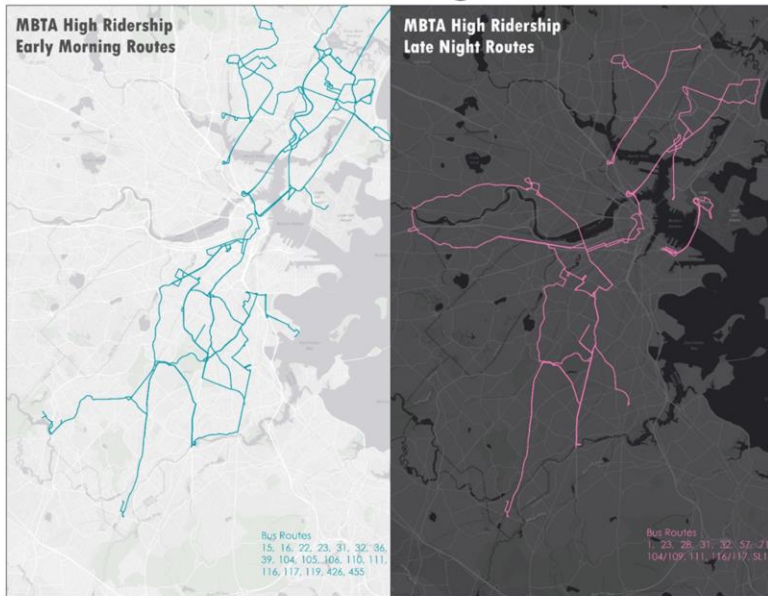


MBTA Overnight Survey of Potential Passengers – Nov/Dec 2016



80 to 90% of the respondents who said they were “extremely” and “very likely” to use overnight bus service report that they will use it at least once per week. At “somewhat likely”, over 50% of the respondents would use the service less than once per month or even less frequently.

MBTA High Ridership Routes in Early Morning and Late Night

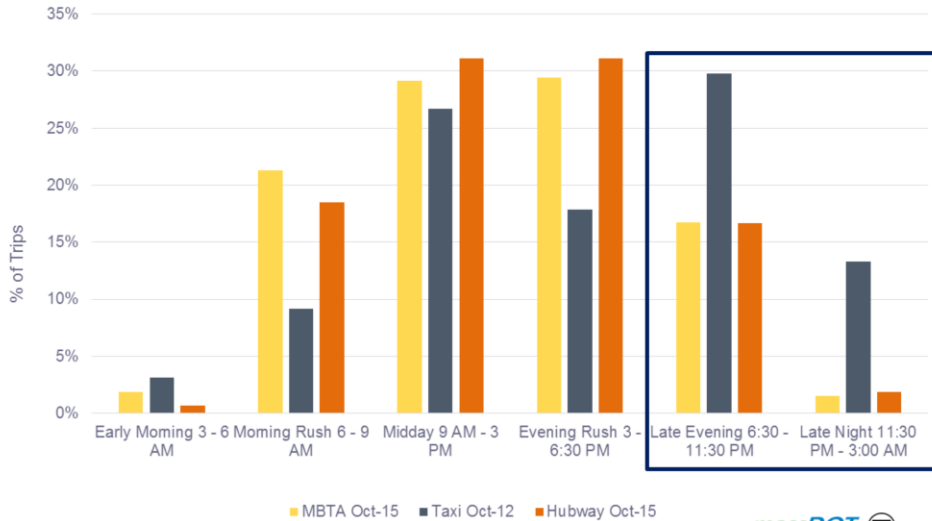


Source: All ridership is from MBTA 2015 APC composite data



These maps show bus routes with over 40 passengers in the first/last trip of the day. The exact start times of first and last trips depend on the bus routes.

Comparatively High Taxi Use Late Night



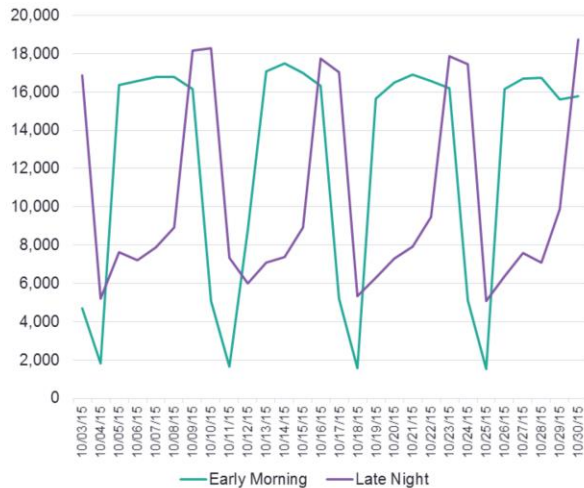
This graph shows the percent of each mode's trips that were in each time period. For example, 2% of the MBTA's trips in October 2015 were in the Early Morning Time Period. 3% of Taxi trips in October 2012 were in the Early Morning time period, while 13% of Taxi trips in October 2012 were in the late night time period. The percentage of trips in the early morning and late night for MBTA and Hubway were similar, while taxi was much higher in the late night proportionally. This might suggest that taxi trips are making up for some of the volume of trips not provided by other services during this time period.

LATE NIGHT VS. EARLY MORNING

Demand and Origin and Destination patterns not evenly distributed between 1am-5am and differences in types of travelers

Early vs Late System Use by Day

- Consistent patterns week to week
- Late night use spikes on Friday/Saturday nights (with a slight rise on Thursday nights)
- Early morning use is high Monday-Friday, similar to a normal commuting pattern

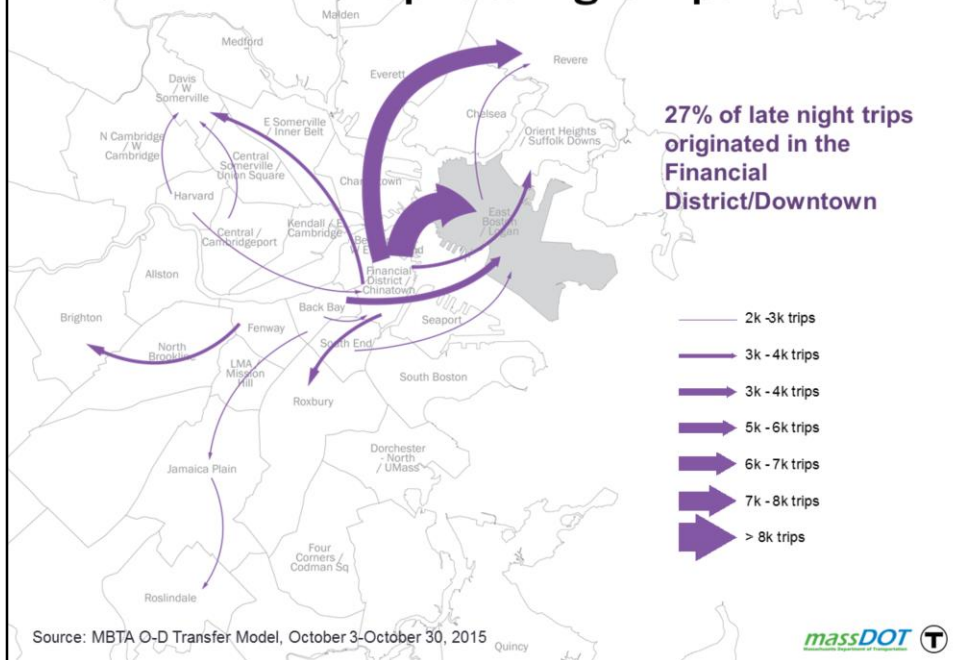


Source: MBTA O-D Transfer Model, October 3-October 30, 2015

There are consistent early morning and late night patterns week over week in October 2015.

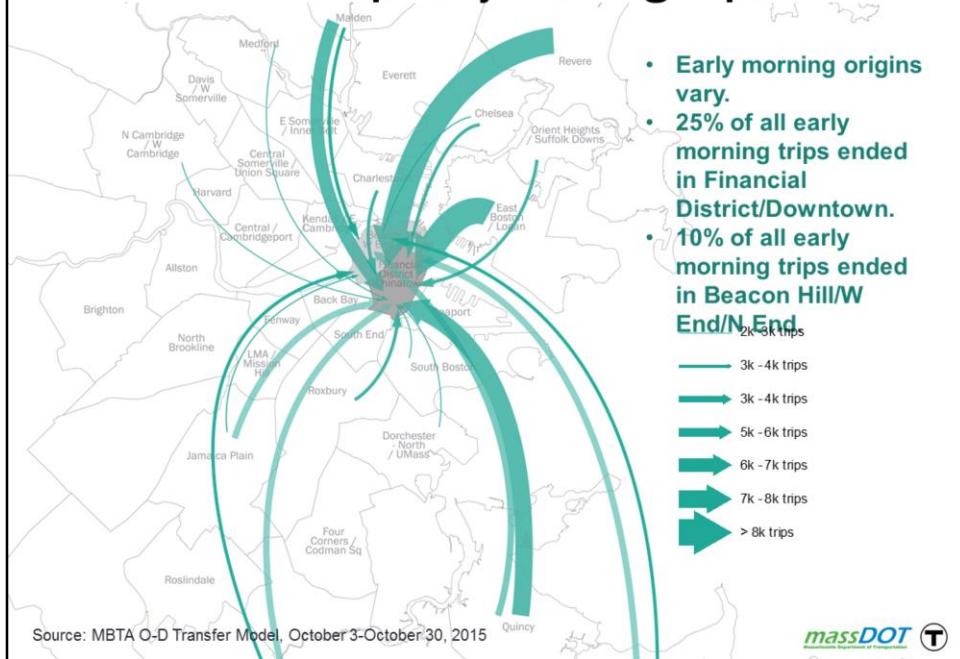
There are more journeys in the early morning than late night (~350k vs. 290k) because there are more weekdays, however there appear to be more distinct riders in late night than early morning.

MBTA Top Late Night Trips



Late night trips are more concentrated in a few areas than early morning trips.

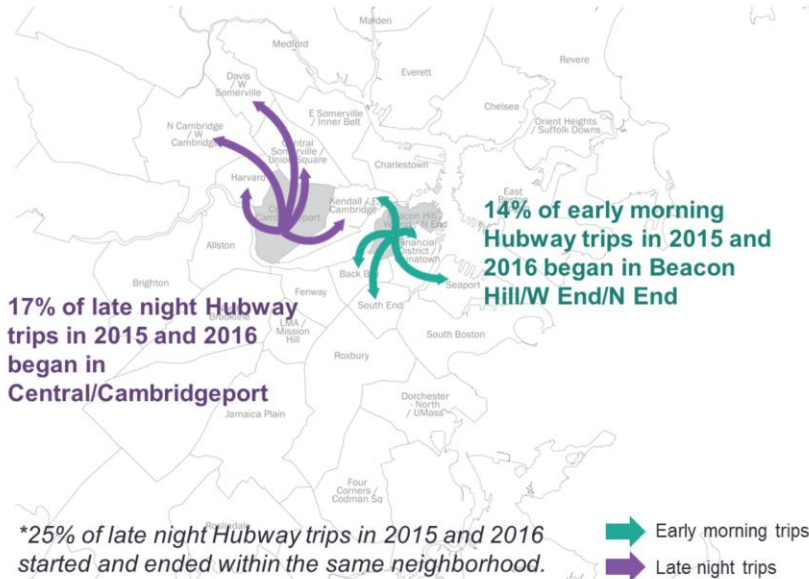
MBTA Top Early Morning Trips



There is more variety in the early morning origin-destination pairs than in the late night.

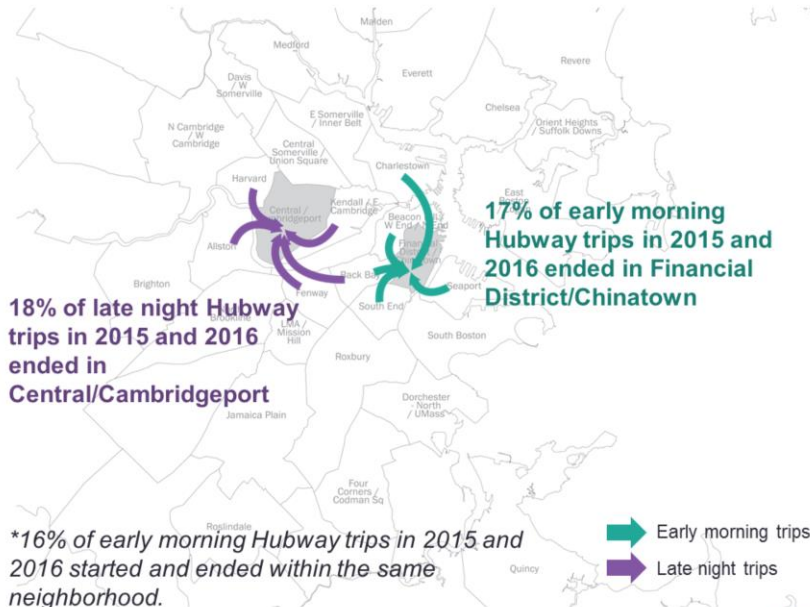
Geographic spread is very different in the early morning than in the late night.

Hubway Top Origins to Destinations



The majority of trips are within the same neighborhood or to/from an adjacent neighborhood. As we saw in the MBTA data, the early morning and late night usage differs in terms of origin-destination pairs and number of rides. There were approximately 2,750 rides in the late night vs. 930 rides in the early morning in October 2016.

Hubway Top Destinations from Origins

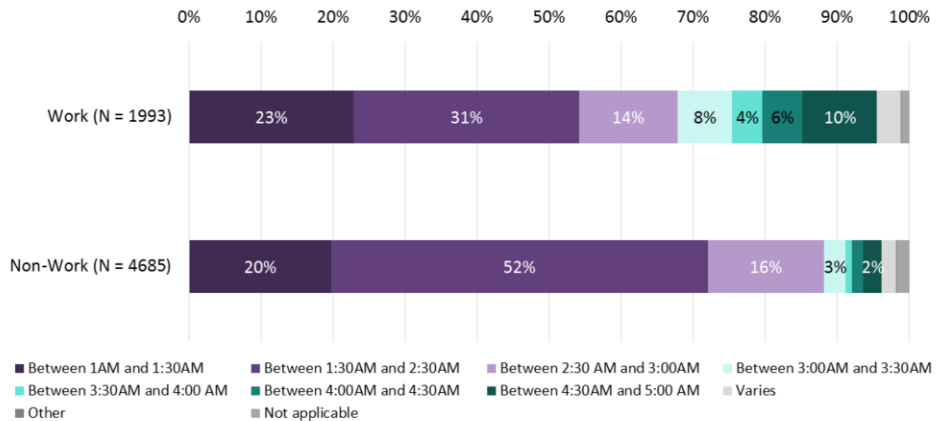


Source: Hubway trip history data 2015 and 2016



The majority of trips are within the same neighborhood or to/from an adjacent neighborhood. As we saw in the MBTA data, the early morning and late night usage differs in terms of origin-destination pairs and number of rides. There were approximately 2,750 rides in the late night vs. 930 rides in the early morning in October 2016.

Optimal Boarding Time



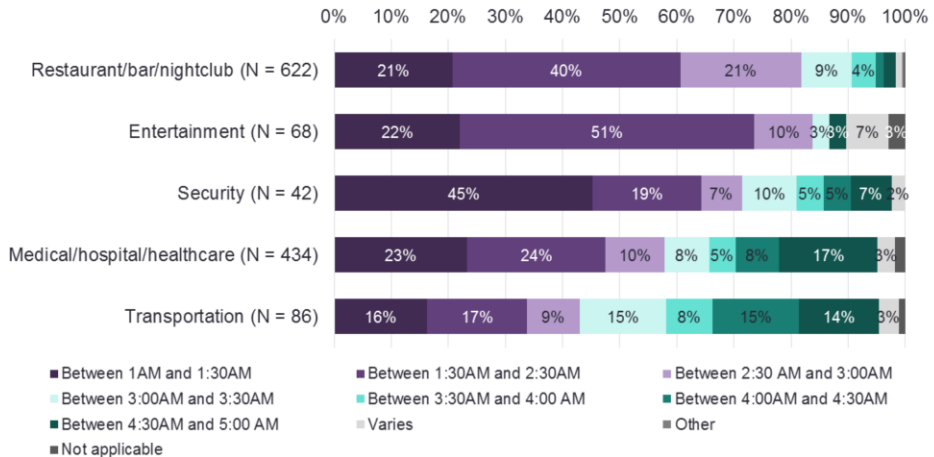
Employers report most arrival or departure times between 1am and 3am, with variation by industry and size of employer

MBTA Overnight Survey of Potential Passengers – Nov/Dec 2016, City of Boston Employer Survey – Nov/Dec 2016



Optimal boarding times for most survey respondents who travel for Non-Work reasons were in the late night (before 3am). Optimal boarding times for survey respondents who travel overnight for Work reasons were more split.

Optimal Boarding Time by Industry



MBTA Overnight Survey of Potential Passengers – Nov/Dec 2016

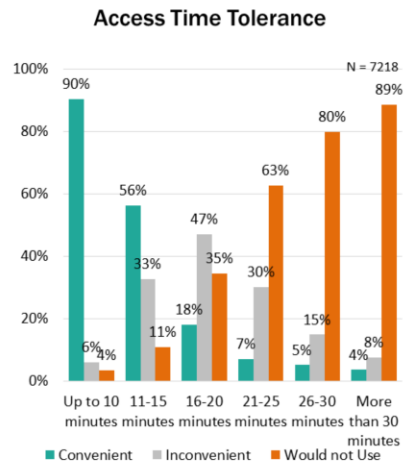
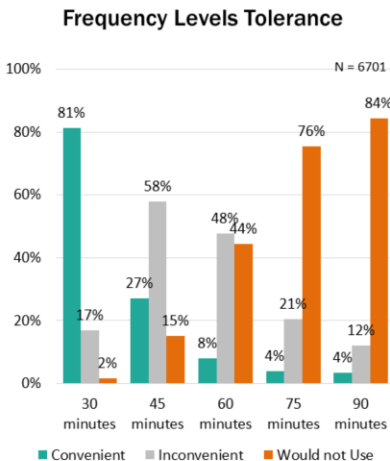


Optimal boarding times vary by industry. Restaurant and entertainment industries are the most concentrated in the late night time period, while medical and transportation industries are much more evenly distributed throughout the 1-5am period.

SERVICE CONSTRAINTS

- Frequency and access time to service stated preference
- Since no rail, need to determine where rail alternatives are needed and where people are primarily using rail in order to transfer to bus
- Fare payment and pass usage

Level of Service Preferences



MBTA Overnight Potential Passenger Survey – Nov/Dec 2016

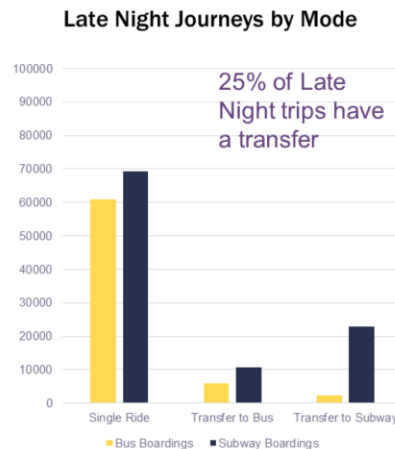
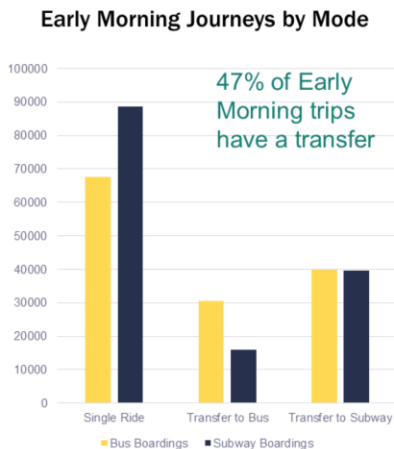


Level of convenience with frequency drops off significantly between 30-45 minutes between vehicles. At frequency intervals longer than 45 minutes, a very large proportion of respondents would stop using the service.

Level of convenience with access time (minutes walking to service) drops off significantly after 15 minutes.

The level of service preferences do not vary substantially by demographic categories or by purpose of travel.

People are more likely to Transfer in Early Morning than Late Night

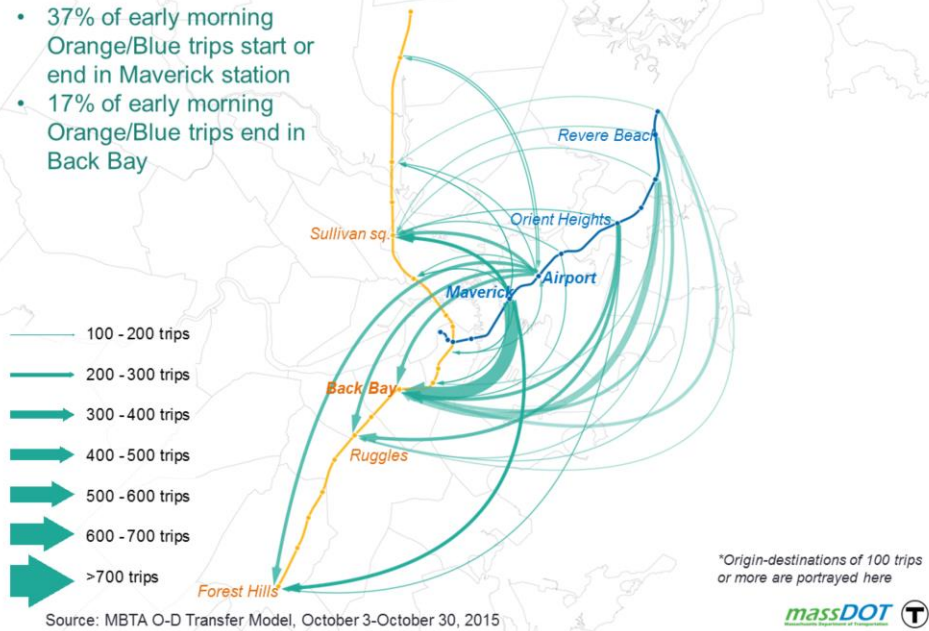


Source: MBTA O-D Transfer Model, October 3-October 30, 2015

More people transfer in the early morning than in the late night.
The early morning had more transfers to bus and subway while late night transfers were mostly subway to subway.

Case Study: Early morning Orange/Blue transfers

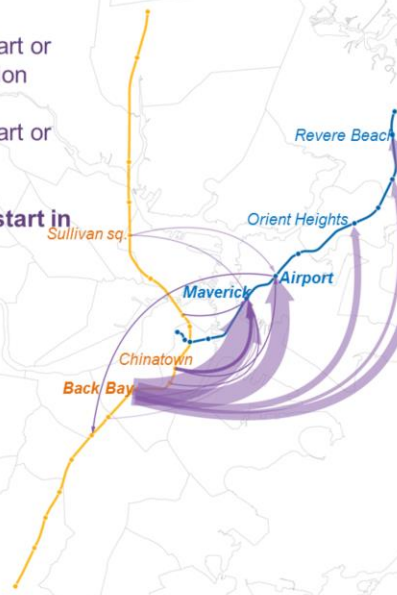
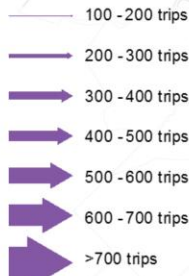
- 37% of early morning Orange/Blue trips start or end in Maverick station
- 17% of early morning Orange/Blue trips end in Back Bay



A key transfer observed during the late night and early morning happened between the Orange and Blue lines. Similar to MBTA origin-destinations in general – the early morning period O-D pattern is more evenly distributed across stops while late night trips are more concentrated in a few areas (see next slide)

Case Study: Late night Orange/Blue transfers

- 36% of late night Orange/Blue trips start or end in Maverick station
- 24% of late night Orange/Blue trips start or end at the Airport
- **38% of late night Orange/Blue trips start in Back Bay**



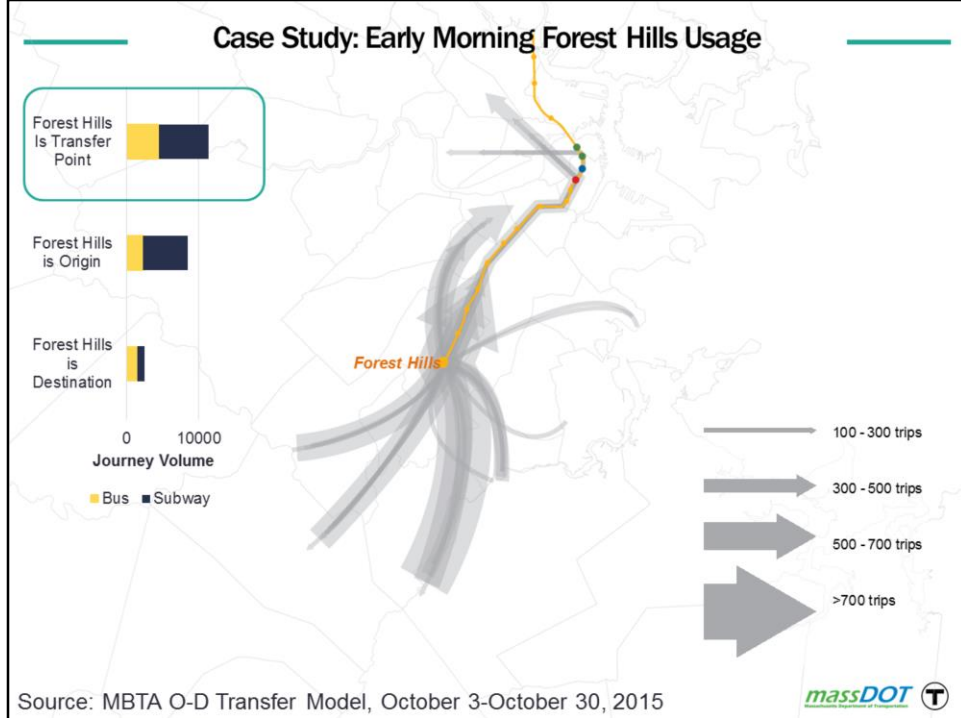
*Origin-destinations of 100 trips or more are portrayed here

Source: MBTA O-D Transfer Model, October 3-October 30, 2015



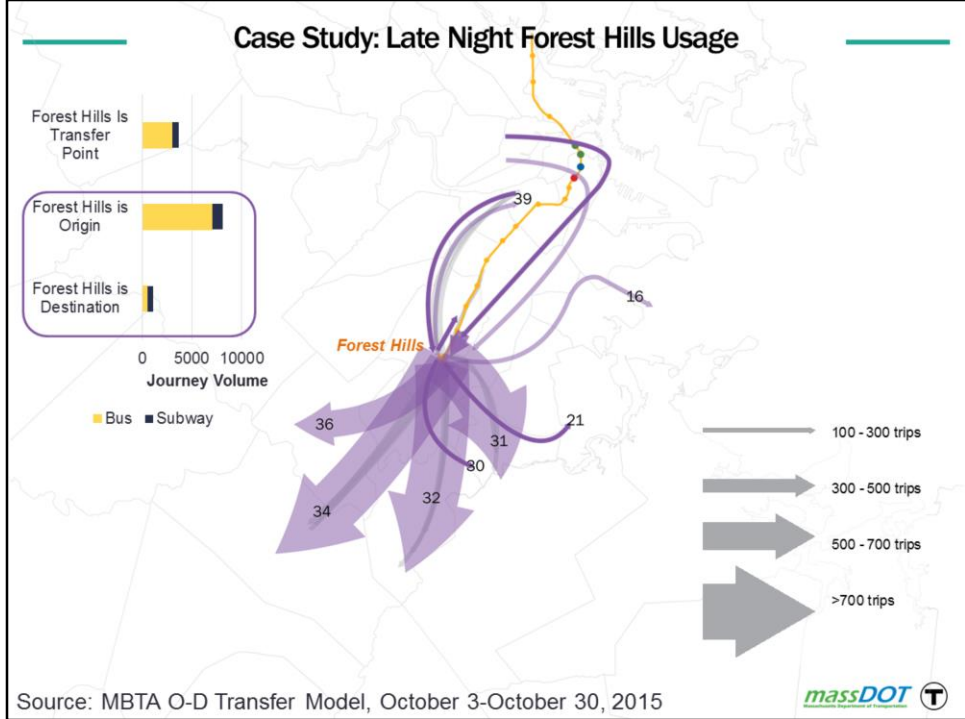
The late night origin-destination patterns with an Orange/Blue transfer are more concentrated, with many rides from Back Bay to various stops along the Blue Line. Airport station is a key destination in the late night, but not a key origin in the early morning. Maverick is a key destination in late night and origin in the early morning.

Case Study: Early Morning Forest Hills Usage



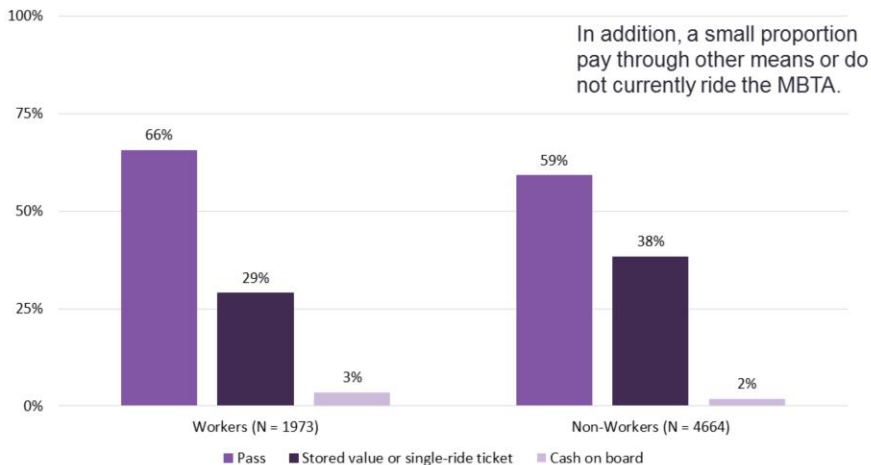
Another case study is usage of Forest Hills in the late night and early morning. In the early morning, Forest Hills is mainly used as a transfer point and an origin location. The transfers are from bus to the Orange line and other buses, and the origins are mainly on the subway.

Case Study: Late Night Forest Hills Usage



In the late night, Forest Hills is used mainly as an origin location and a transfer point. The origins are mainly on buses going south. The transfers are mainly from bus to bus.

Method of MBTA Fare Payment in Survey



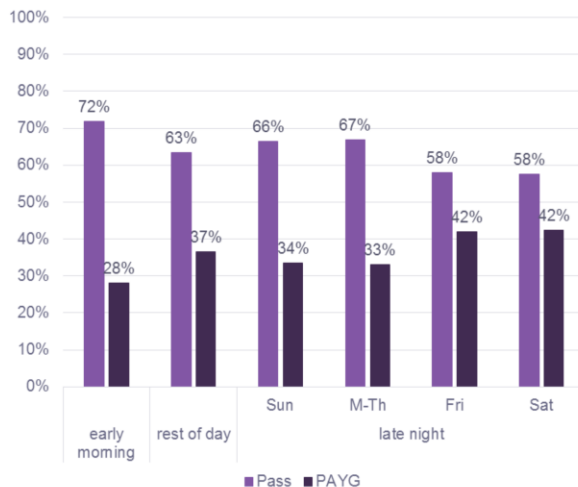
MBTA Overnight Survey of Potential Passengers – Nov/Dec 2016



Survey respondents report high pass usage rates comparable to pass usage with MBTA riders overall.

Pass Rates by Time of Day

- More early morning journeys are made with passes than the typical bus/subway journey.
- Late night journeys (11:30pm-2:59am) have pass rates that are typical for bus/subway.
- When extended late night service was offered (Fridays and Saturdays), fewer journeys used passes.



Source: MBTA O-D Transfer Model, October 3-October 30, 2015

PAYG = pay as you go or stored value card.

TRAVELER TYPES

We identified groups of interest in order to assess their current travel patterns and preferences

- No salient differences in tolerances for different service levels (frequency or access time)
- Large differences in origin-destination patterns, frequency of travel, likelihood of use, and optimal boarding time

Traveler Types



Social/Recreational Travelers

- 3,931 respondents



Airport Travelers

- Traveling to Airport
- 151 respondents



Infrequent Workers

- Travel less than once per month
- 159 respondents



Early Morning Workers

- Begin trips *to* work after 3AM at least once per week
- 323 respondents



Late Night Workers

- Begin trips *from* work before 3AM at least once per week
- 1,062 respondents

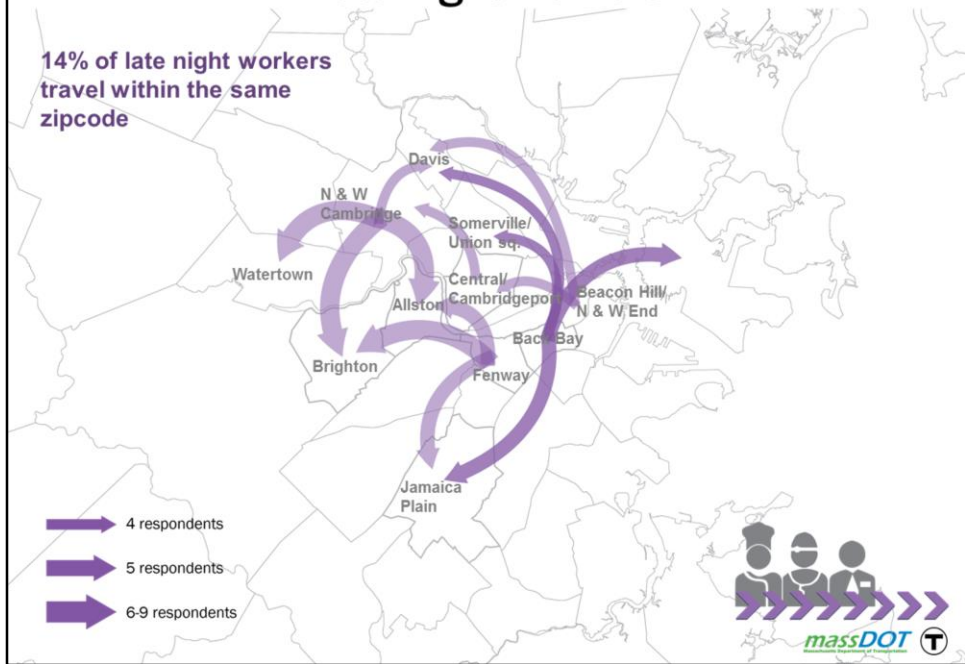
MBTA Overnight Survey of Potential Passengers – Nov/Dec 2016



Not all respondents ended up in one of these five traveler types. Traveler types were identified based on characteristics needed for service design (frequency, time, direction, trip purpose).

Late night workers

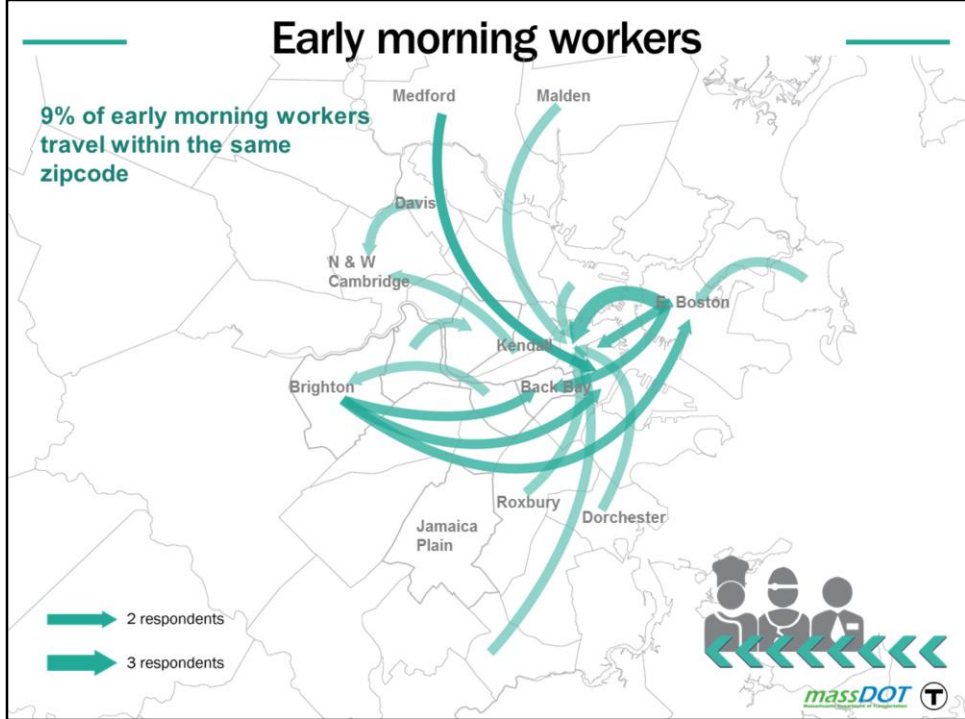
14% of late night workers travel within the same zipcode



Not all survey respondents from this traveler type are mapped due to the lack of origin and destination zip codes provided by respondents. 13% of the late night worker traveler type are mapped here.

Early morning workers

9% of early morning workers travel within the same zipcode



Not all survey respondents from this traveler type are mapped due to the lack of origin and destination zip codes provided by respondents. 19% of the early morning worker traveler type are mapped here.

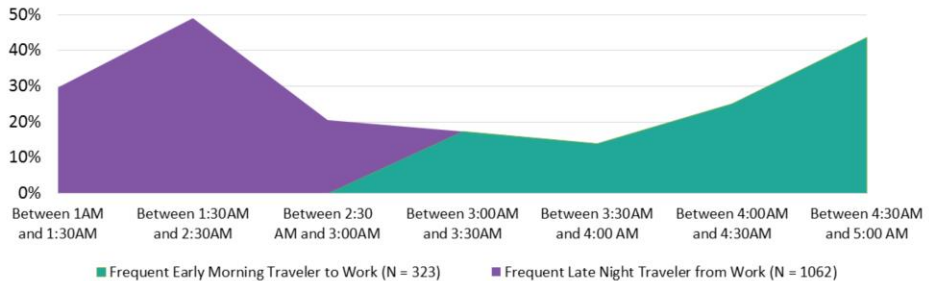


Frequent Work Travelers



- Lowest income distribution and highest proportion of minority respondents of all traveler types
- Top industries are Restaurant/Bar/Nightclub (especially during late night) and Medical/Hospital/Healthcare (especially during early morning)
- Need service throughout the entire night

Optimal Boarding Times for Frequent Work Travelers



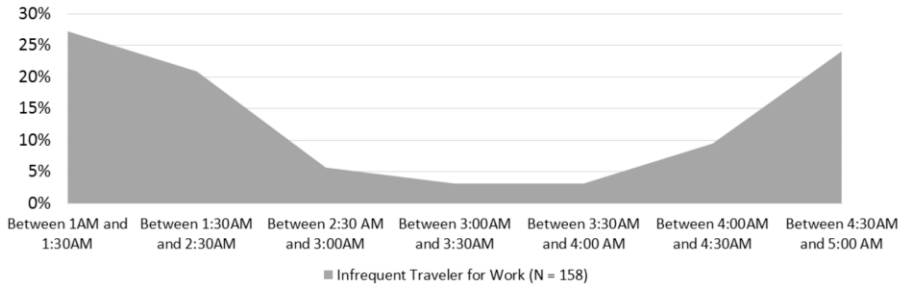
MBTA Overnight Survey of Potential Passengers – Nov/Dec 2016

Infrequent Work Travelers



- Highest income distribution and lowest proportion of minorities of all traveler types (apart from travelers to the airport)
- Top Industries: Medical/hospital/healthcare (28%), Research/academic (20%)
 - High proportion of workers in "Other" industries, usually Architecture, Law, Finance, or a similar industries
- Begin trips at the shoulders of the service period

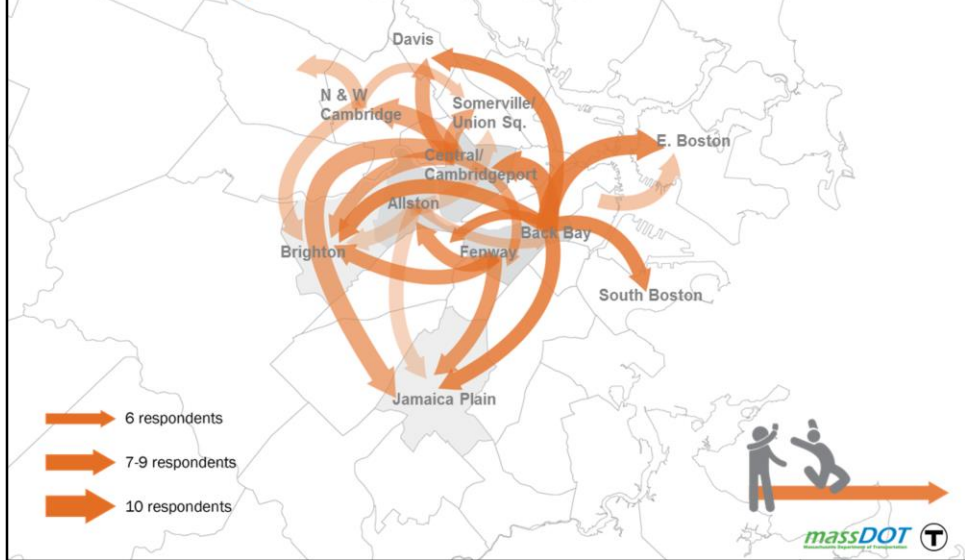
Optimal Boarding Times for Infrequent Workers



MBTA Overnight Survey of Potential Passengers – Nov/Dec 2016

Social travelers

21% of social travelers travel within the same zipcode

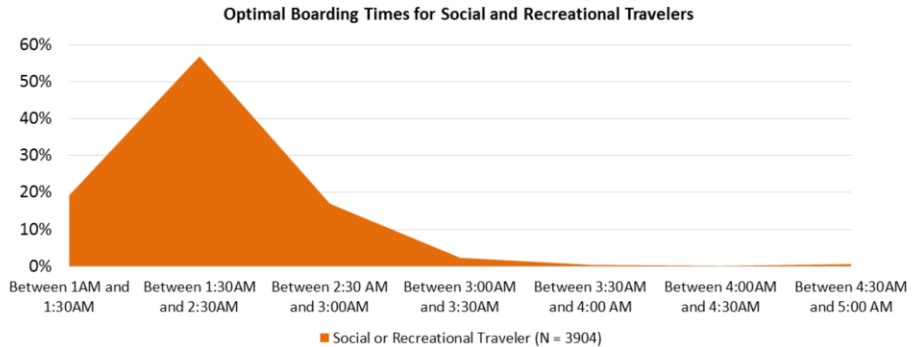


Not all survey respondents from this traveler type are mapped due to the lack of origin and destination zip codes provided by respondents. 16% of the social traveler type are mapped here.

Social or Recreational Travelers



- Over half travel one or two times per week
- Vast majority are done boarding by 3AM
- Make up the majority of respondents in our dataset who travel between 1AM and 5AM



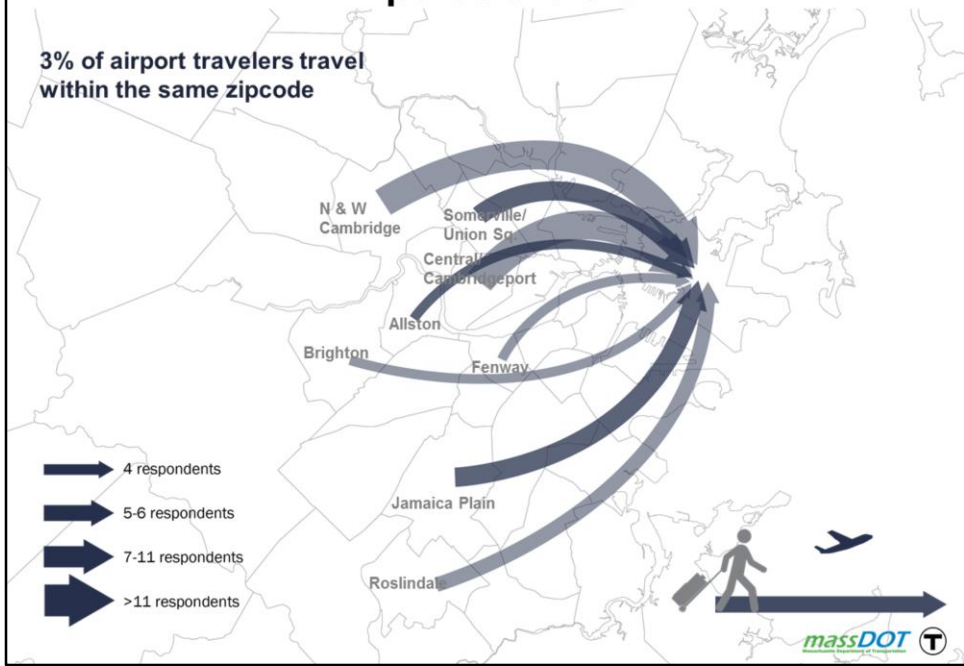
MBTA Overnight Survey of Potential Passengers – Nov/Dec 2016



This traveler type makes up 58% of survey respondents who said they travel between 1AM -5AM.

Airport travelers

3% of airport travelers travel within the same zipcode



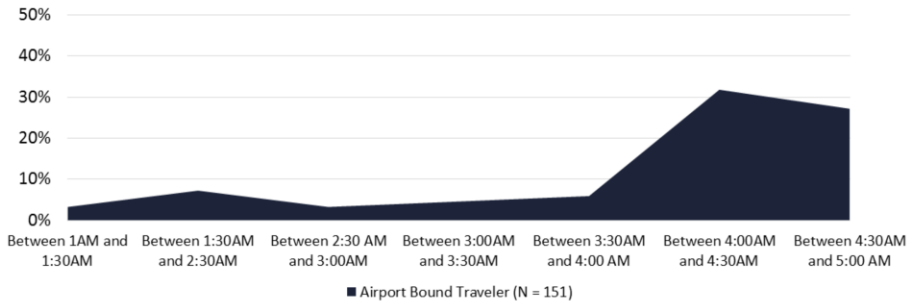
The airport traveler type are people traveling to the airport, not airport workers. Not all survey respondents from this traveler type are mapped due to the lack of origin and destination zip codes provided by respondents. 46% of the airport traveler type are mapped here.

Airport Bound Travelers



- Highest income distribution and proportion of non-minority respondents
- 89% travel less than once per month
- Most common current method of transportation is using a taxi or ride-sharing service (90%)
- Least likely to say that they would use a potential overnight bus service of all traveler types
- Least tolerant of having to walk to a boarding point of all traveler types, and widely dispersed in their origin locations

Optimal Boarding Times for Airport Bound Travelers



MBTA Overnight Survey of Potential Passengers – Nov/Dec 2016



Only 39% of this traveler type say they're extremely likely to use overnight bus service (in contrast to about 75% of our frequent workers).

Conclusions

- Evidence of demand between 1am-5am, but not evenly distributed
- Origin-Destination patterns differ by time period and by traveler types
- Early morning origins more spread out geographically
- Social/Recreational trips largely done by 3am
- Frequent work trips peak between 1:30-2am and 4:30-5am, but more constant throughout night than other trip types
- Service frequency has to be at most every 45 minutes

Next Steps

- Is there enough need to justify providing service? If so,
- What are the parameters
 - Who: Which traveler types should be prioritized
 - Where: What part of our service area should be covered
 - When: Is this still overnight or late night and/or early morning
 - How often: Waiting and access time tolerances
 - How much: What funding level or subsidy
- Release data and ask for service proposals
- Evaluate service proposals after pilot policy completed